

# **Monitoring Avian Productivity and Survivorship (MAPS) and it's role in Denali National Park's Long-Term Ecological Monitoring**

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# **Monitoring Avian Productivity and Survivorship (MAPS) Program Protocols**

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- 10 mist nets at fixed points
- Operated 6 hours per day
- Operated one day per 10 day period, June 10 to August 8
- Captured birds identified to species, age, sex
- Captured birds are banded with USGS/BRD leg band
- Breeding status for each species is determined for each station

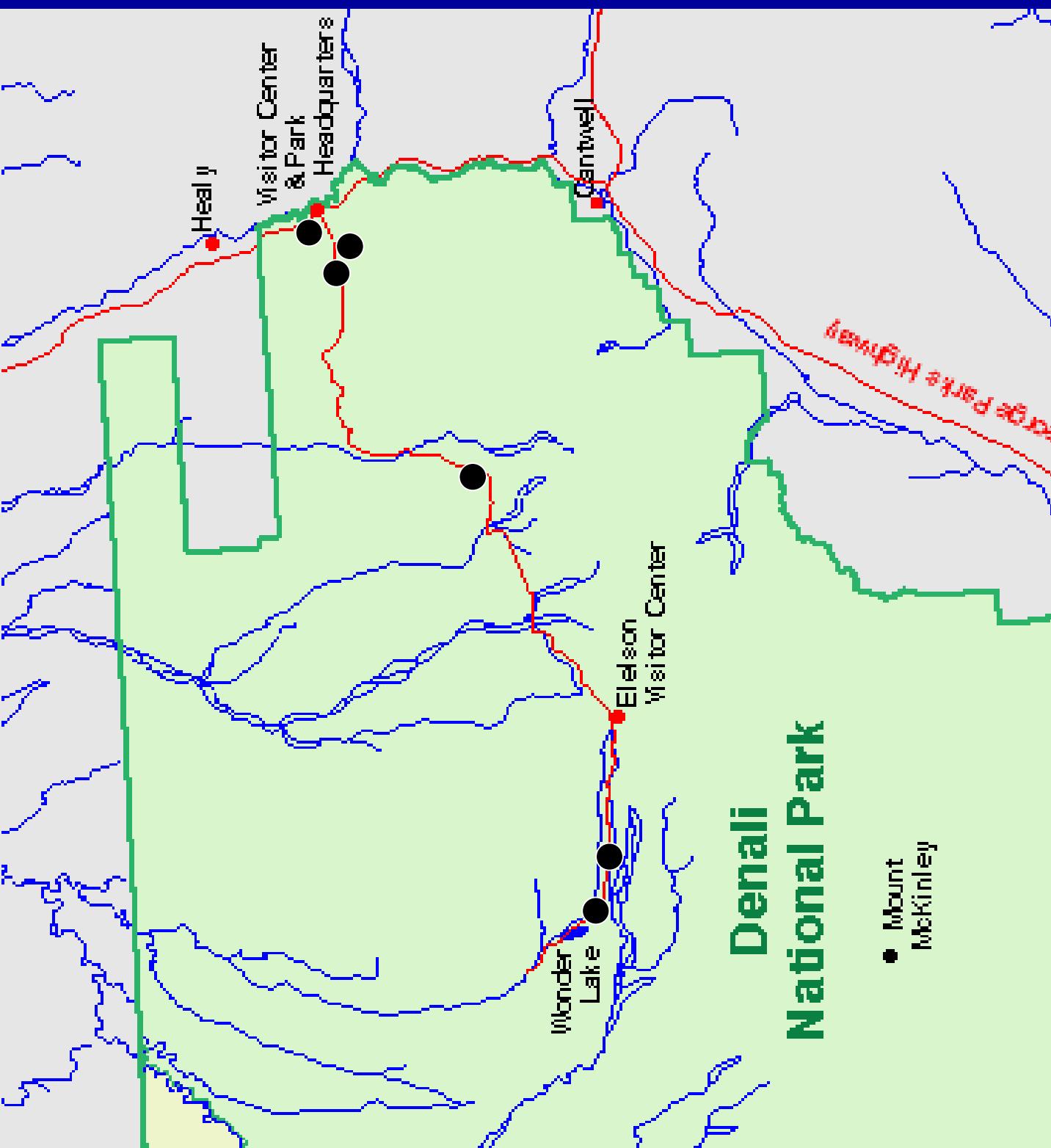
# **Monitoring Avian Productivity and Survivorship (MAPS) Analyses**

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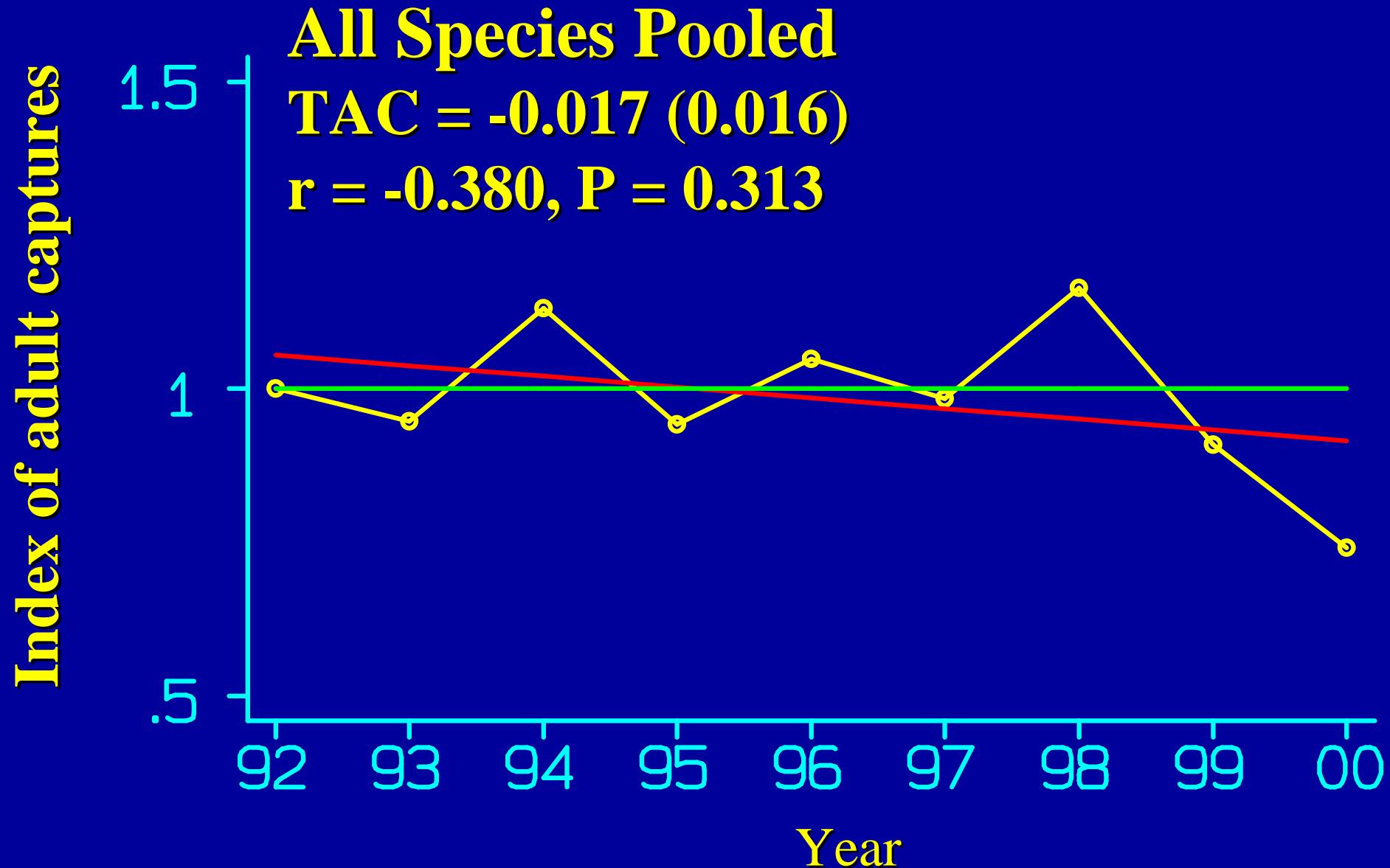
- Use regular breeders (> 50% of the years)
- Adult population size is indexed by the number of adults
- Productivity is indexed by proportion of young in the catch
- Adult survival rate is estimated using CJS mark-recapture models
- Model selection using AIC techniques

# Denali National Park

• Mount  
McKinley



# Trends in adult captures at Denali NP

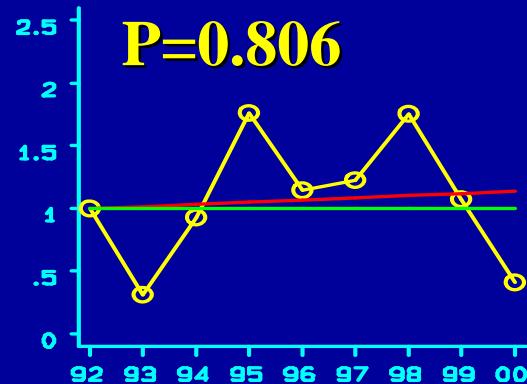


# Trends in adult captures at Denali NP

OCWA

TAC=+0.018

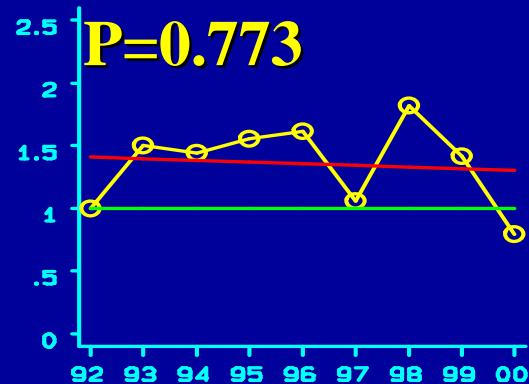
P=0.806



WIWA

TAC=-0.014

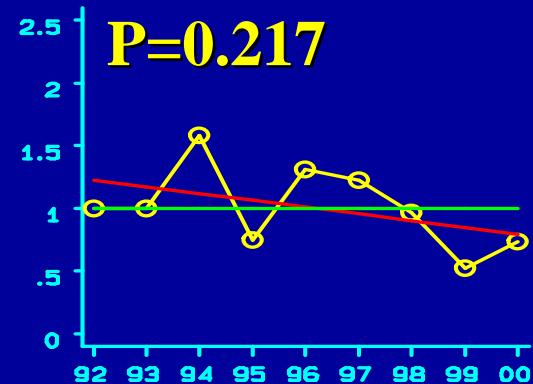
P=0.773



ATSP

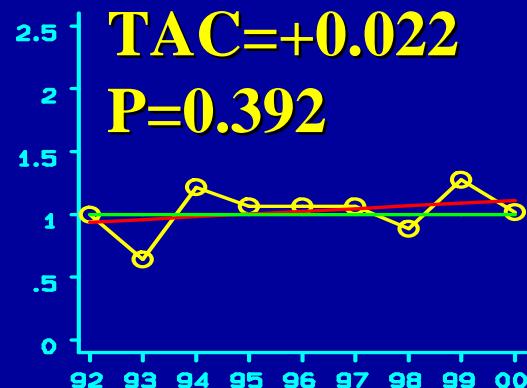
TAC=-0.054

P=0.217



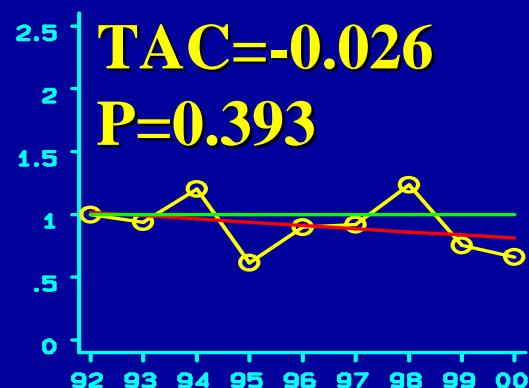
DEJU

TAC=+0.022  
P=0.392



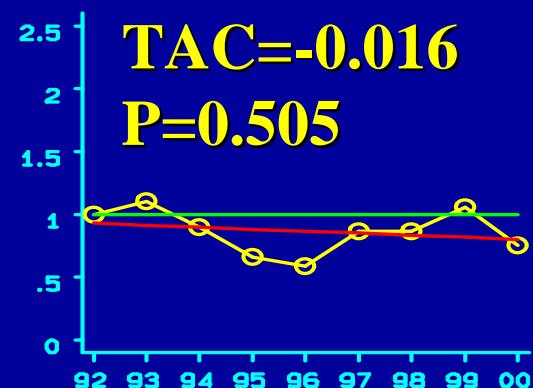
WCSP

TAC=-0.026  
P=0.393



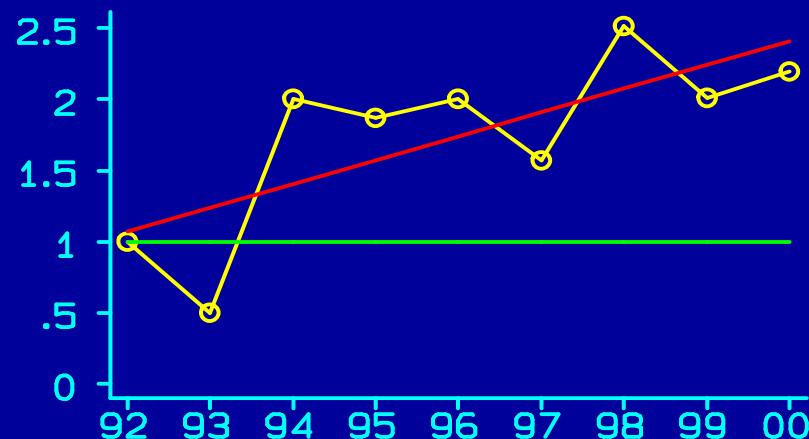
CORE

TAC=-0.016  
P=0.505

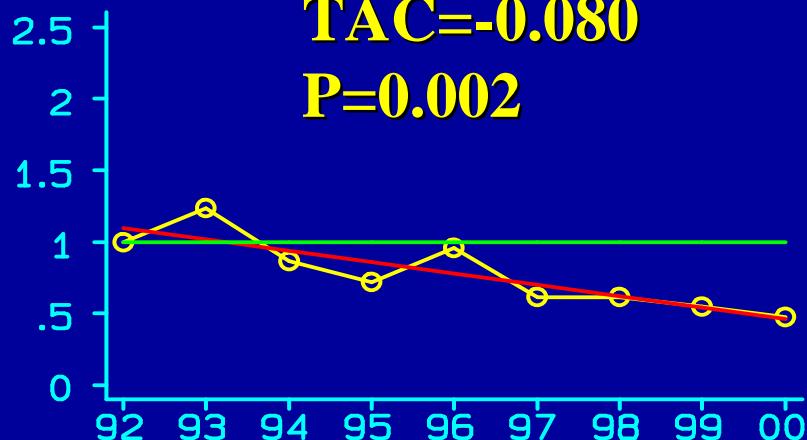


# Trends in adult captures at Denali NP

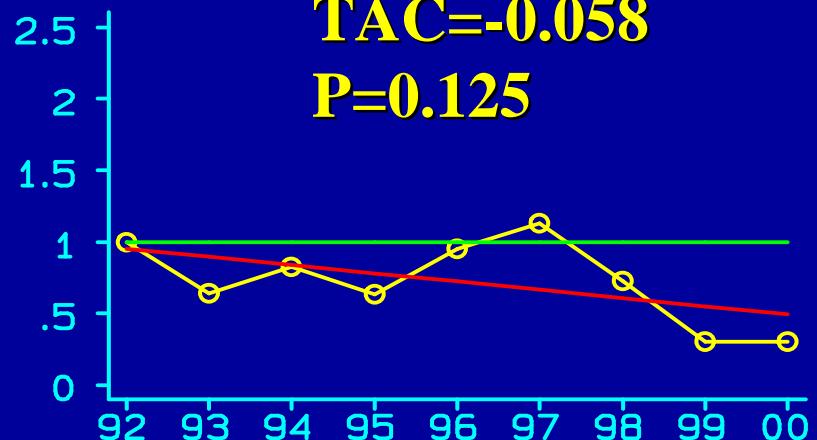
YRWA  
TAC= $+0.167$   
P=0.025



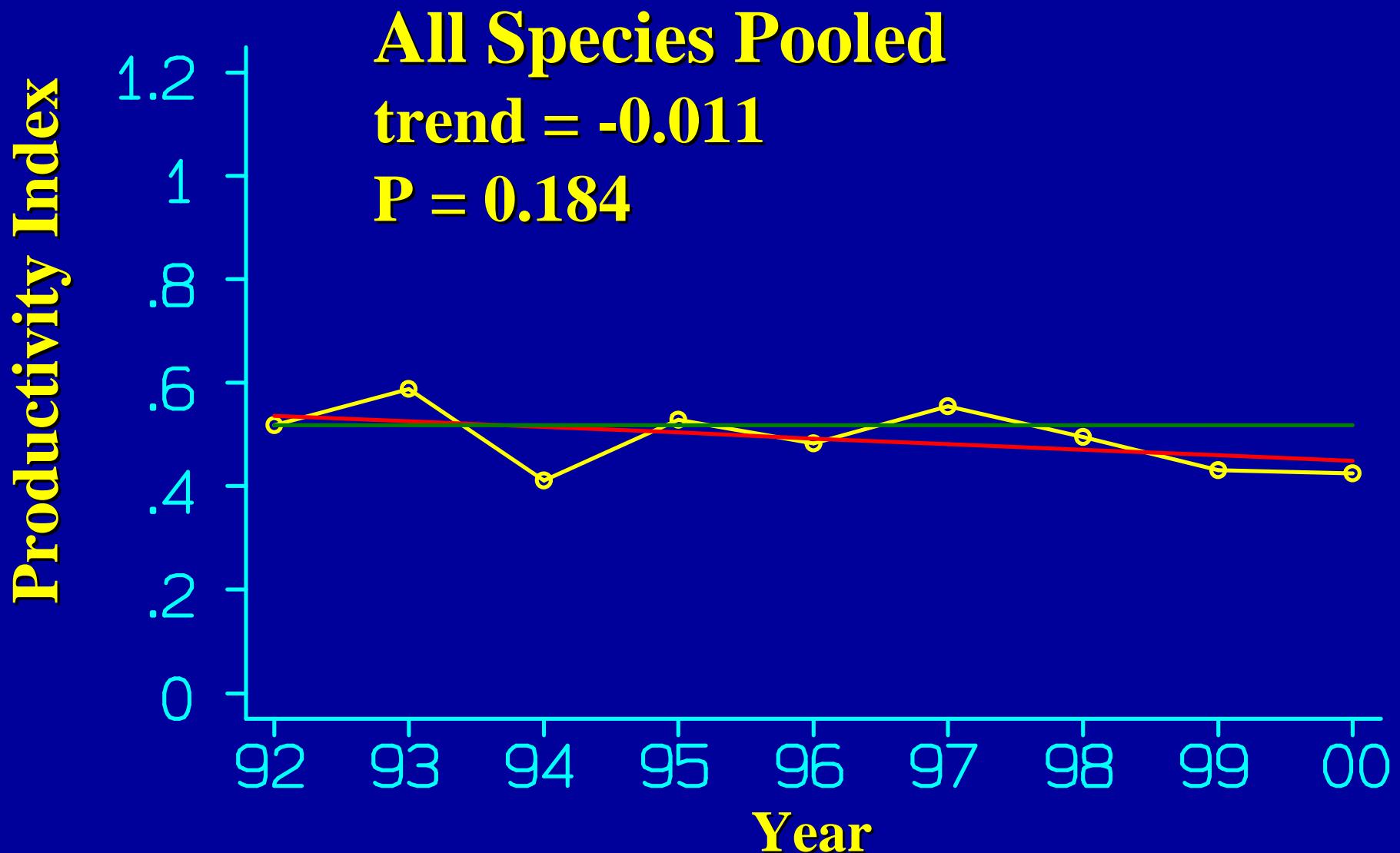
SWTH  
TAC= $-0.080$   
P=0.002



ARWA  
TAC= $-0.058$   
P=0.125



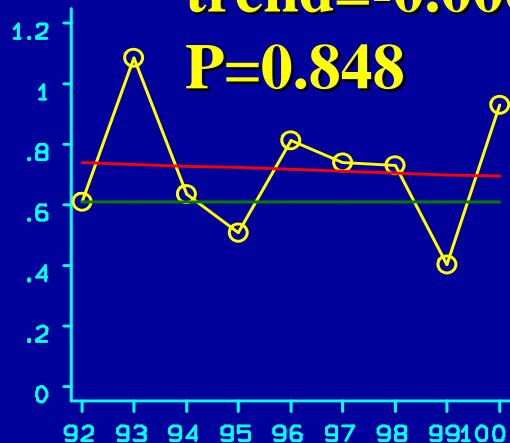
# Productivity at Denali NP



# Productivity at Denali NP

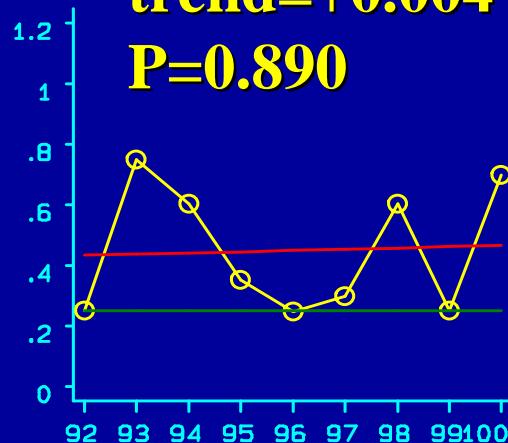
OCWA

trend=-0.006  
P=0.848



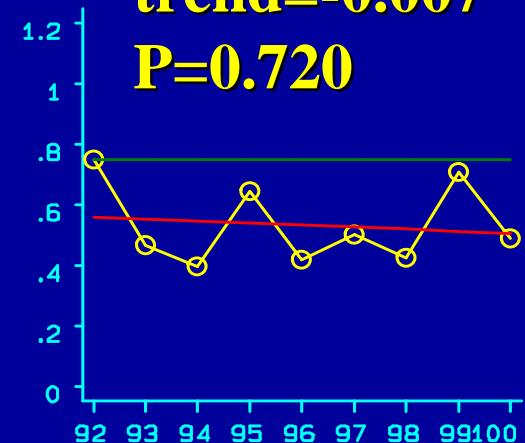
YRWA

trend=+0.004  
P=0.890



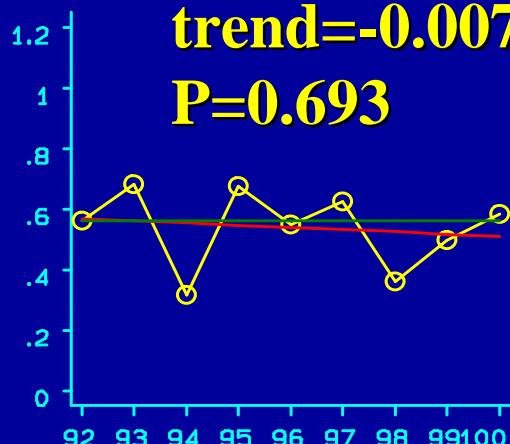
ATSP

trend=-0.007  
P=0.720



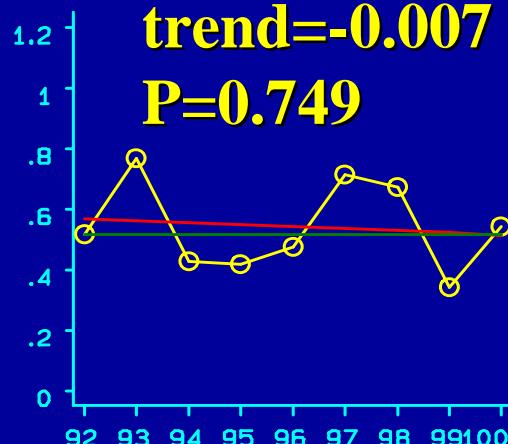
WCSP

trend=-0.007  
P=0.693



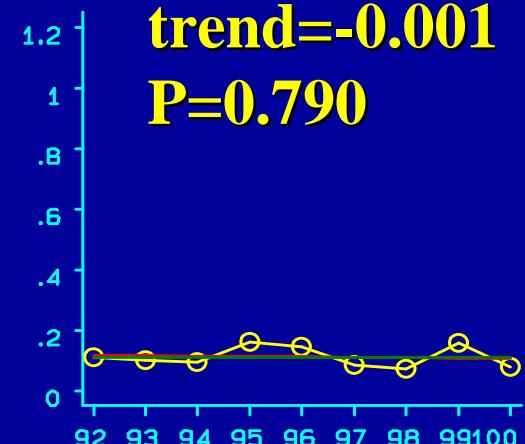
DEJU

trend=-0.007  
P=0.749



CORE

trend=-0.001  
P=0.790



# Productivity at Denali NP

**ARWA**

trend=+0.038

P=0.067



**SWTH**

trend=+0.023

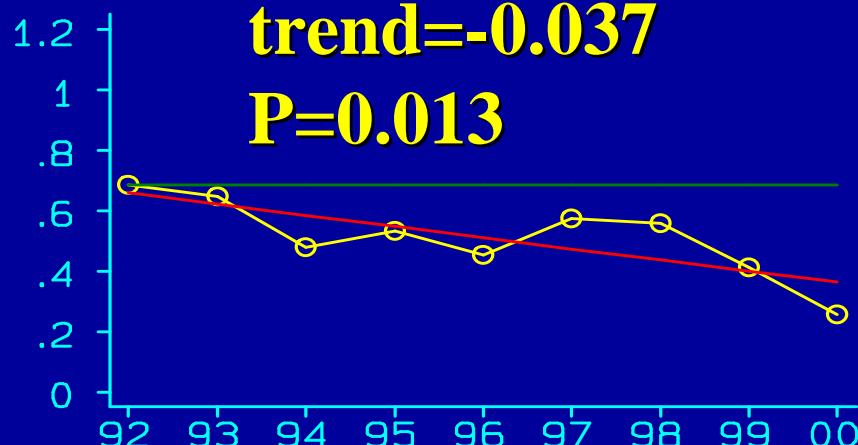
P=0.070



**WIWA**

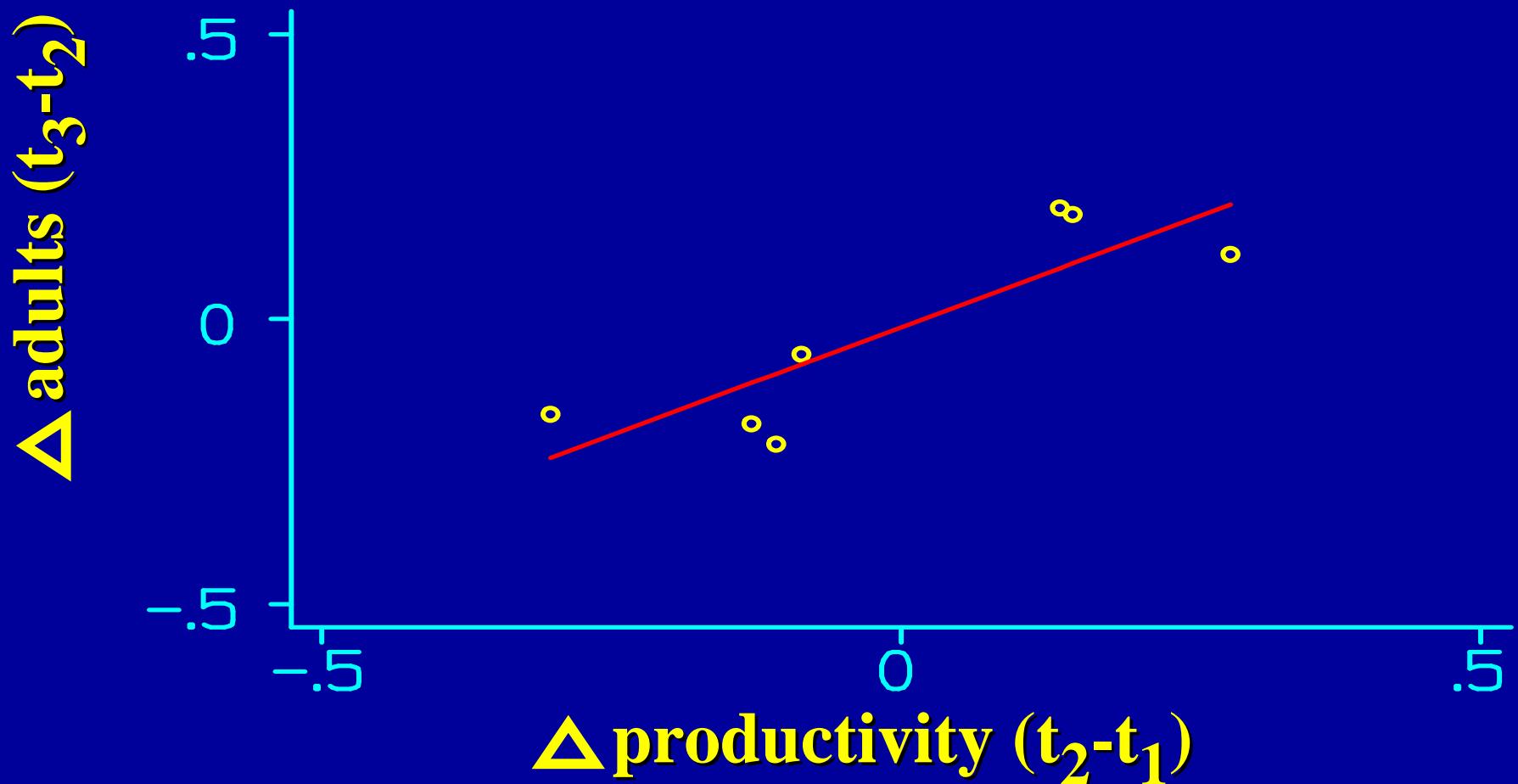
trend=-0.037

P=0.013

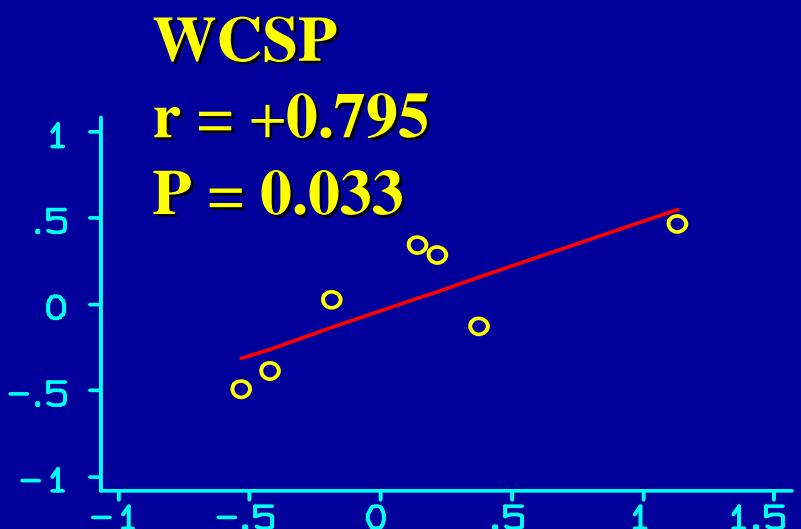
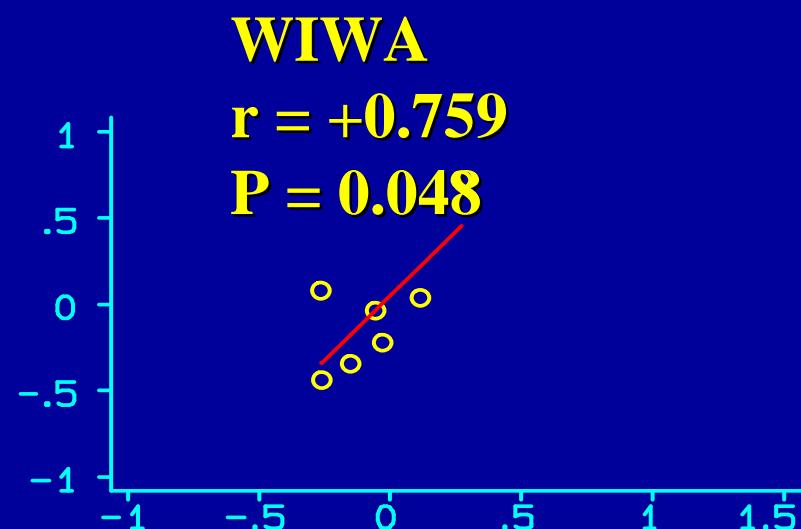
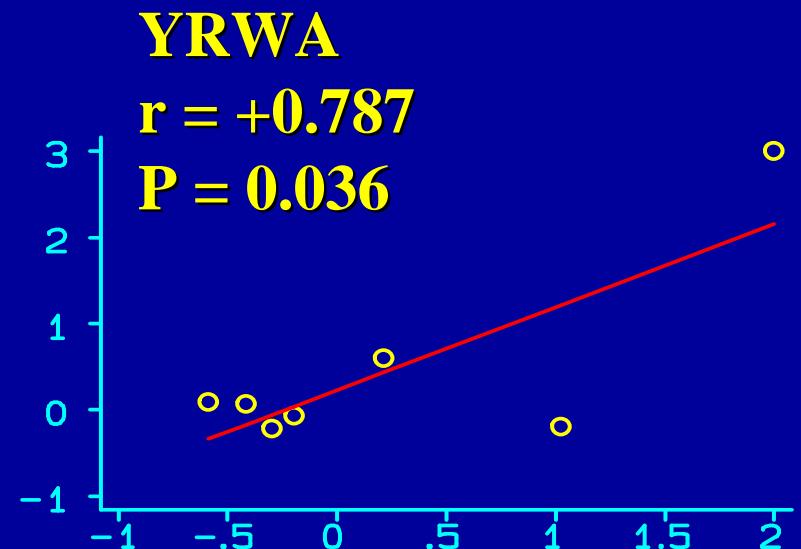
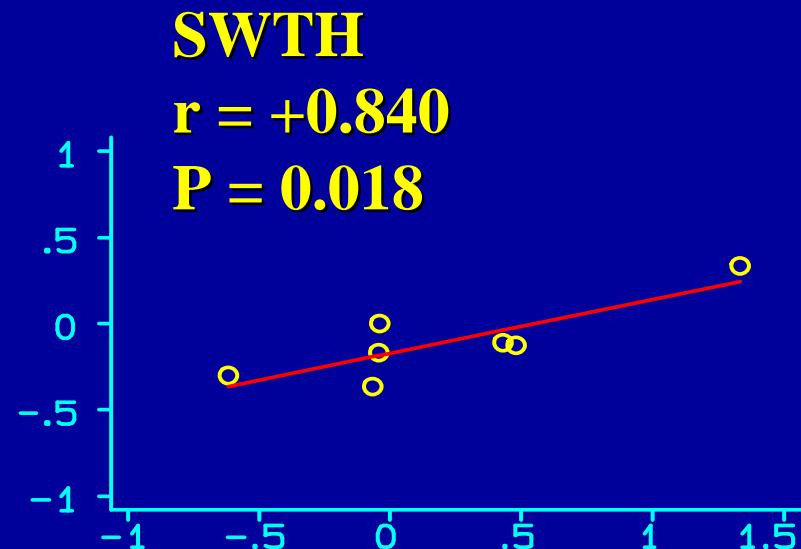


# $\Delta$ productivity ( $t_2-t_1$ ) vs $\Delta$ adult captures ( $t_3-t_2$ )

All species pooled  
 $r = +0.854, P = 0.014$



# $\Delta$ productivity ( $t_2-t_1$ ) vs $\Delta$ adult captures ( $t_3-t_2$ )

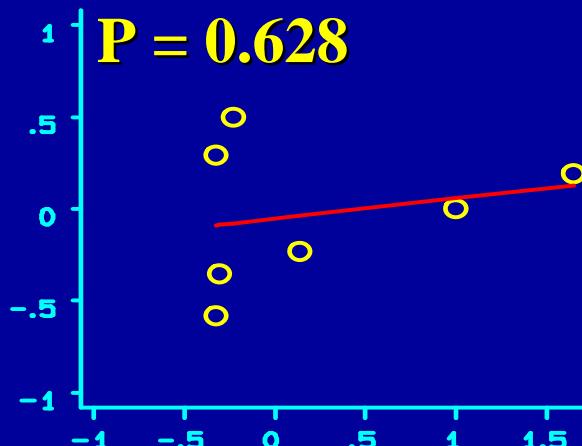


# $\Delta$ productivity ( $t_2-t_1$ ) vs $\Delta$ adult captures ( $t_3-t_2$ )

ARWA

$$r = +0.225$$

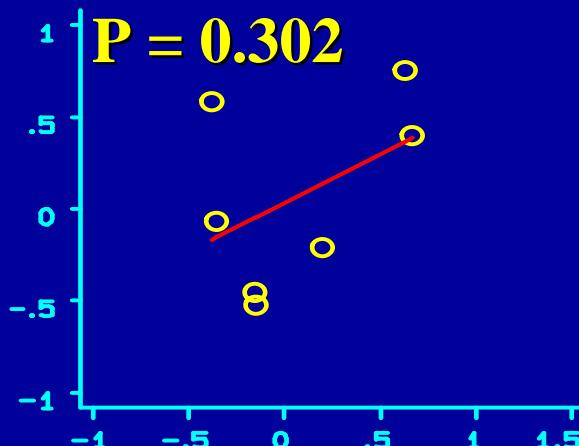
$$P = 0.628$$



ATSP

$$r = +0.457$$

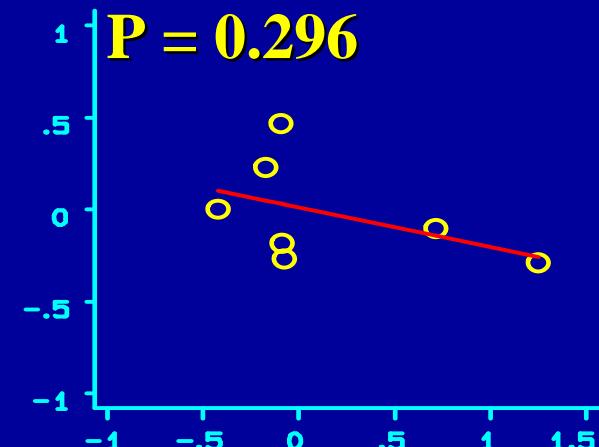
$$P = 0.302$$



CORE

$$r = -0.463$$

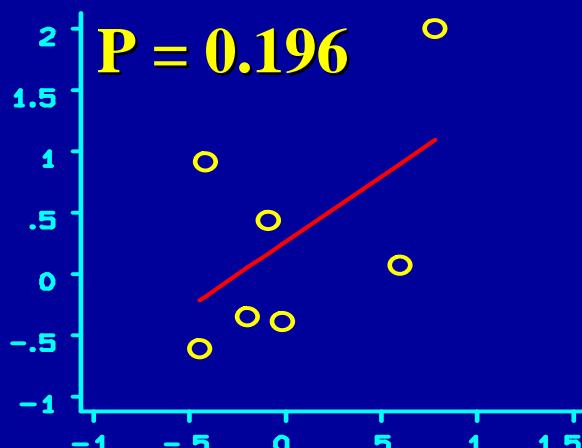
$$P = 0.296$$



OCWA

$$r = +0.555$$

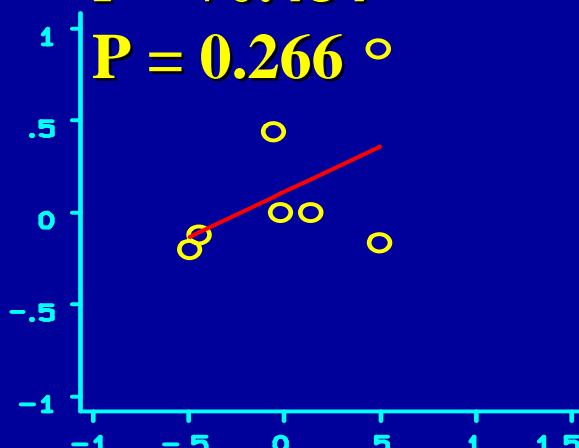
$$P = 0.196$$



DEJU

$$r = +0.484$$

$$P = 0.266$$



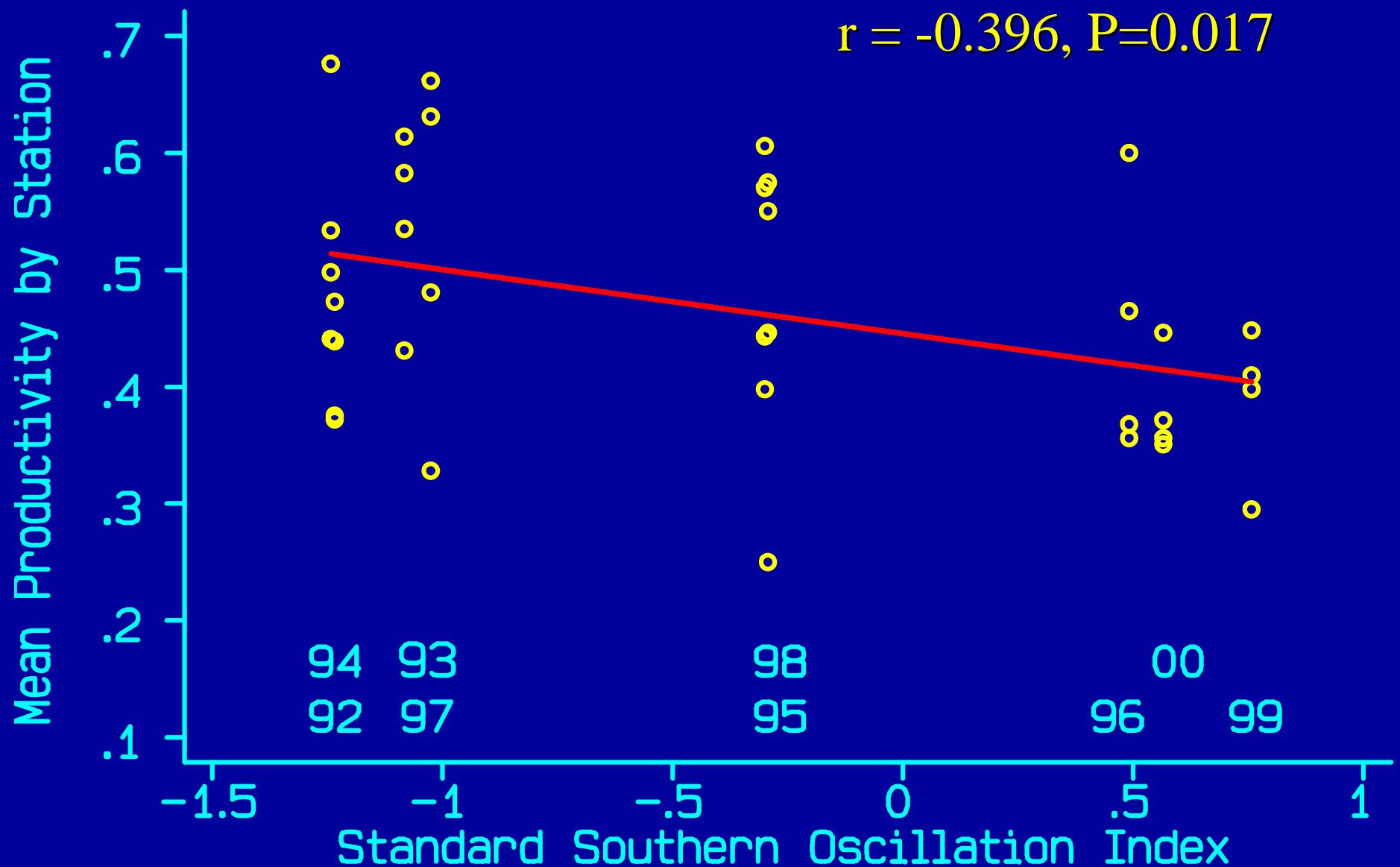
# Time-dependence in Survivorship of Denali NP target species

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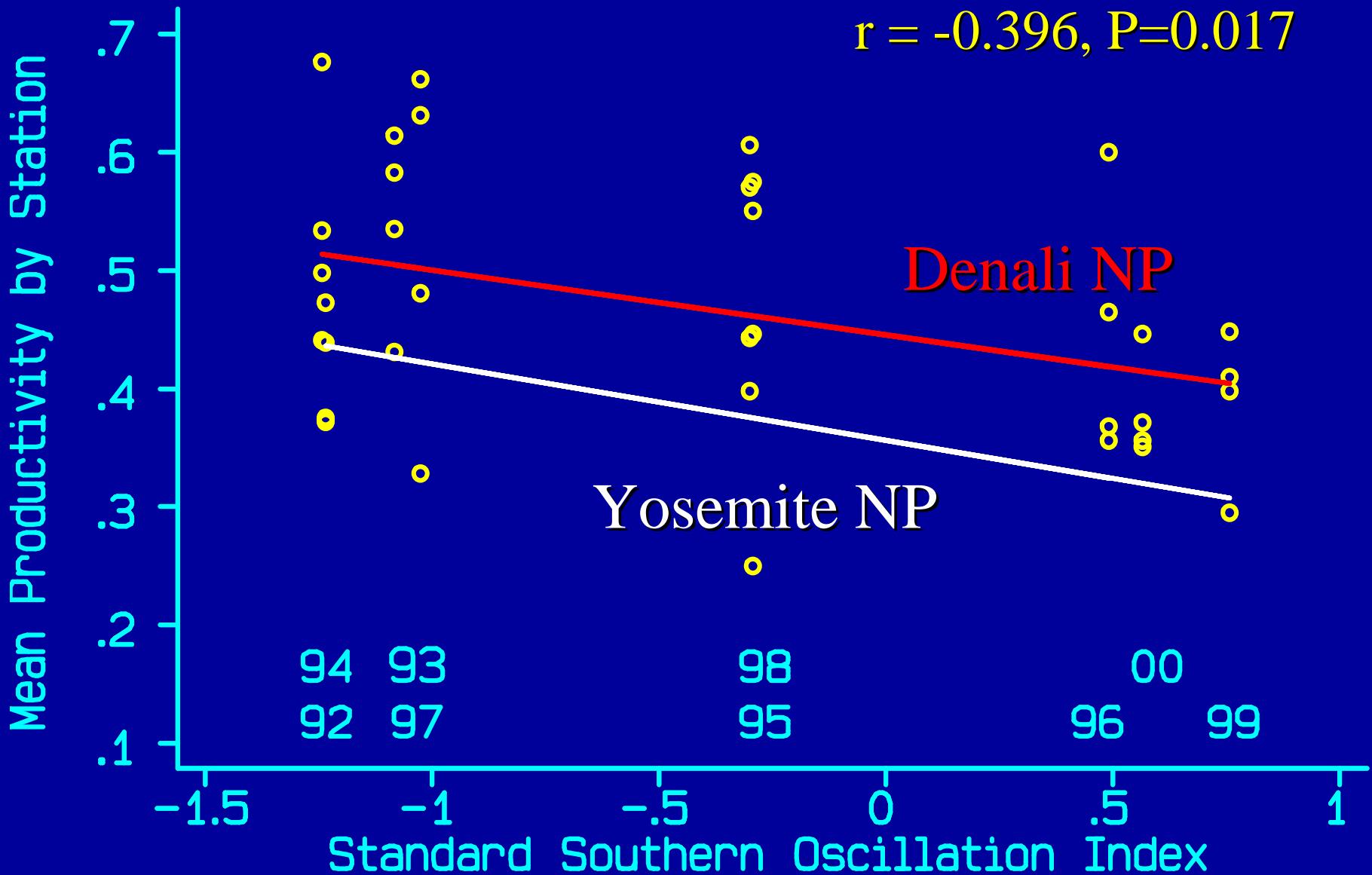
$\Delta \text{AIC} = \text{AIC}(\text{best time-dependent model}) - \text{AIC}(\text{time-independent model})$

SPECIES	$\Delta \text{ AIC}$	SPECIES	$\Delta \text{ AIC}$
ARWA	2.54**	WCSP	9.84
OCWA	6.26*	SWTH	10.12
ATSP	7.05*	WIWA	10.24
DEJU	9.47	YRWA	10.87

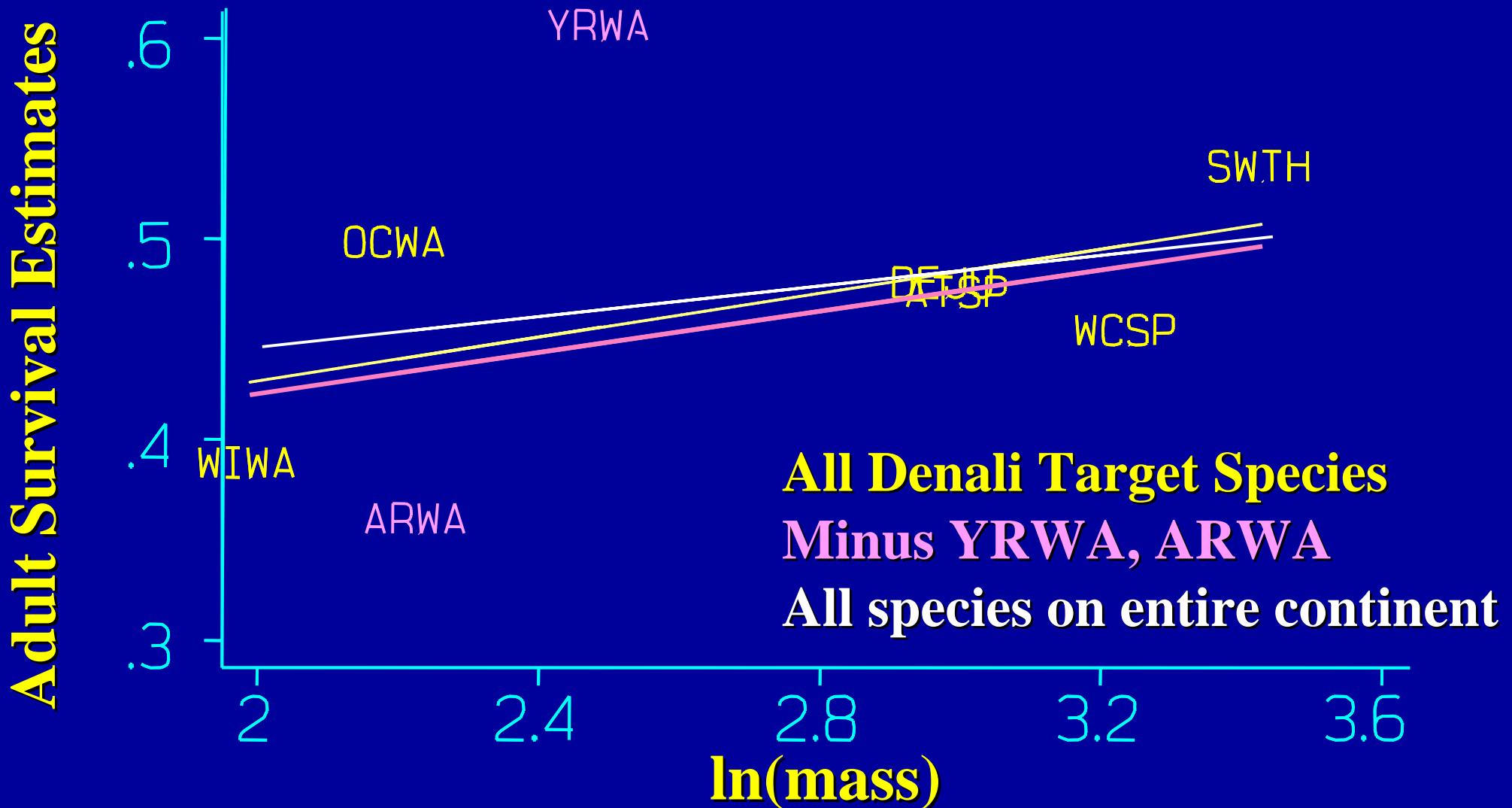
# Productivity vs Standard Southern Oscillation Index



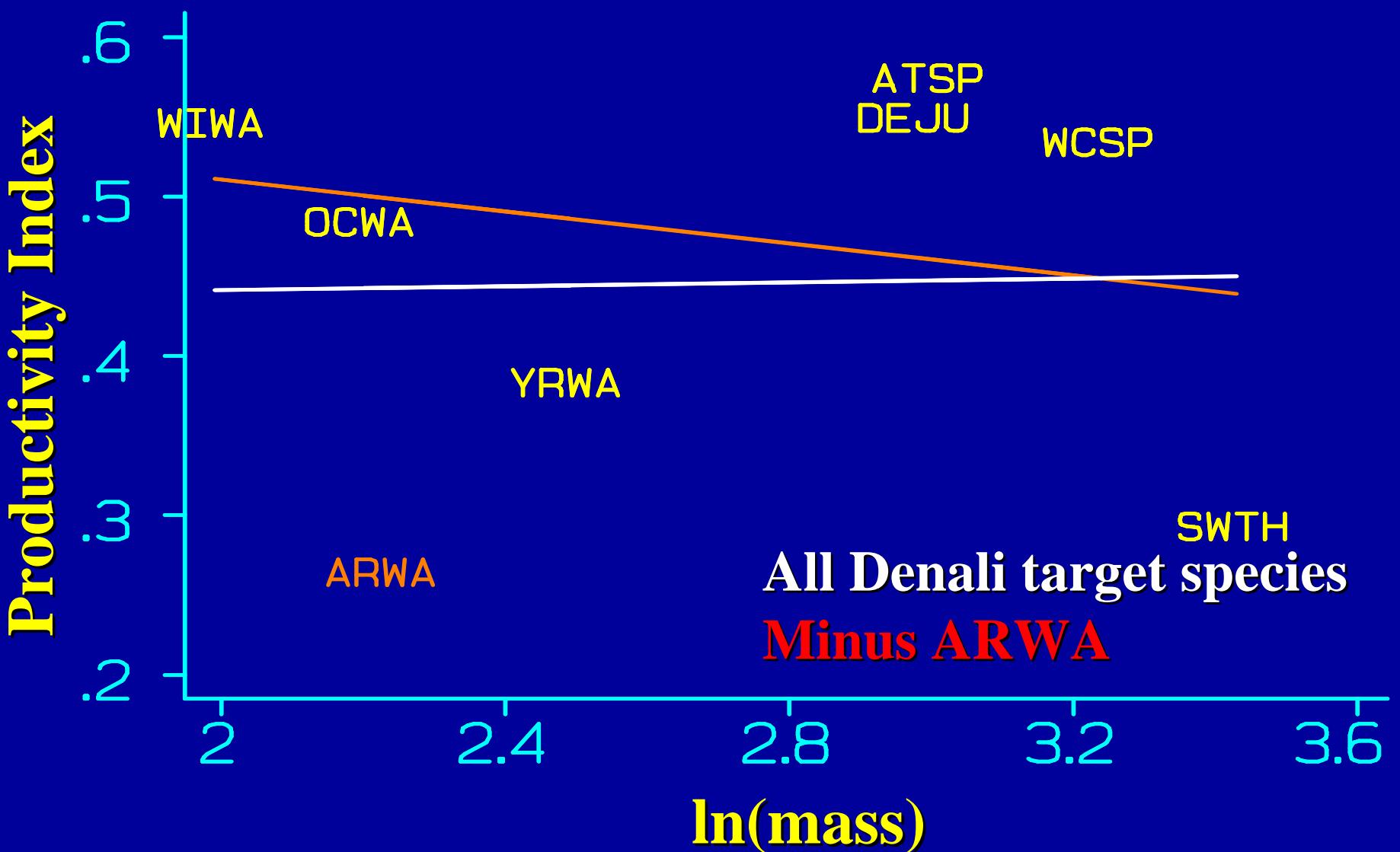
# Productivity vs Standard Southern Oscillation Index



# Adult survival rates as a function of body mass



# Productivity Index as a function of body mass



## **Parameters needed to model population dynamics**

- adult population size
- recruitment into adult population
- adult survival rate

## **Parameters currently obtained from MAPS**

- indices of adult population size
- productivity indices
- estimates of adult survival rates

**Productivity indices are not necessarily equal to recruitment**

- variable first year survival of young
- variable recruitment rate of surviving young

**Newly developed models for mark-recapture data permit**

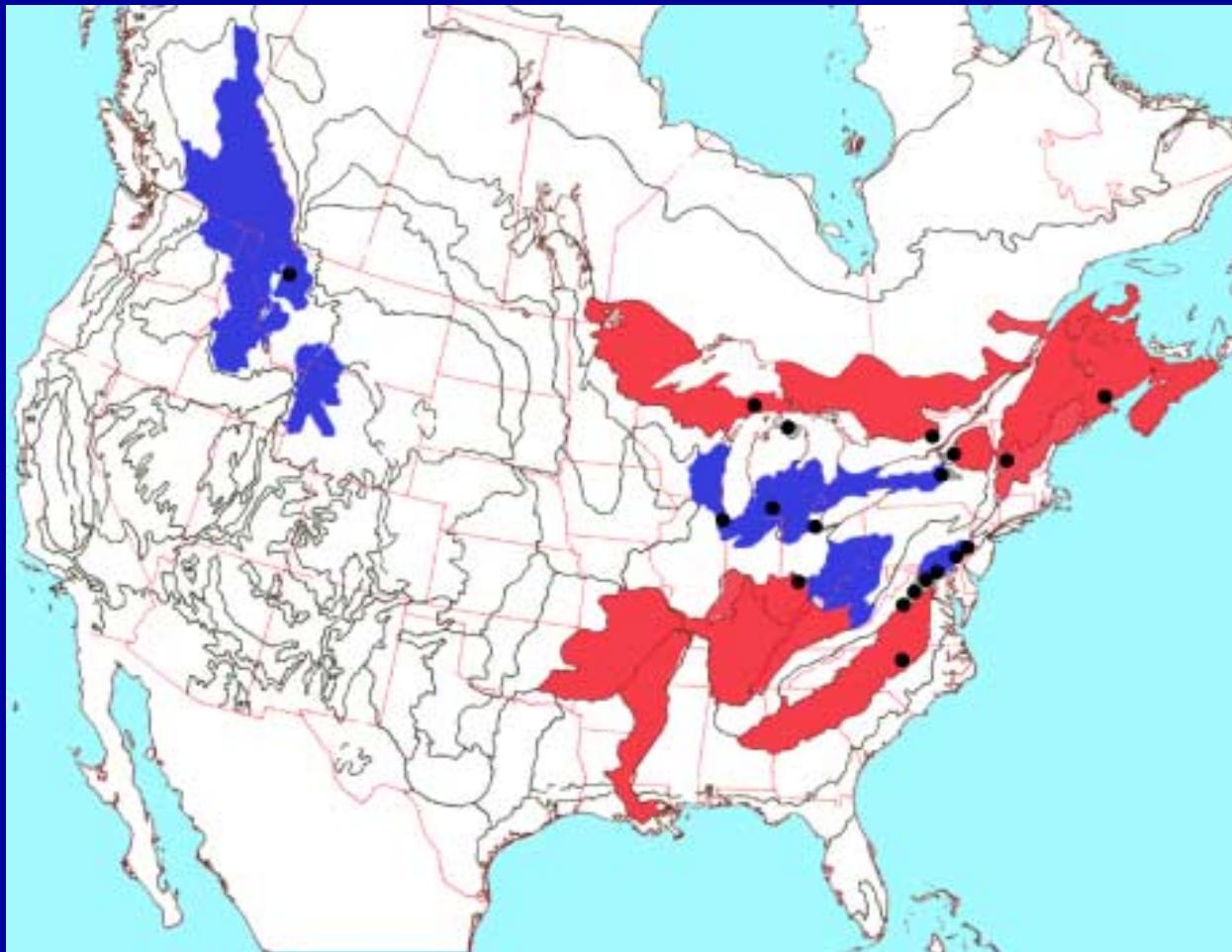
- direct estimation of adult population size
- direct estimation of recruitment

**With accurate aging to SY and ASY**

- estimate emigration/immigration rates
- index first year survival of young

# Catbird population trends in BBS strata

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- BBS physiographic strata with positive population trends represented by 7 MAPS stations
- BBS physiographic strata with negative population trends represented by 10 MAPS stations

# Gray Catbird (*Dumetella carolinensis*)

## Model Selection for Productivity

Productivity models	AIC	Odd Ratio (neg.)	Productivity	
			pos.	neg.
Effort, Area	2791.2*	1.186 (0.146) P=0.165	0.270	0.320
Effort	2791.1**			0.295

# Gray Catbird (*Dumetella carolinensis*)

## Model Selection for Survivorship

Survivorship models	AIC	Survivorship models	AIC
$\phi, P, \gamma$	276.8	$\phi(A), P(A), \gamma$	264.4
$\phi(A), P, \gamma$	262.4*	$\phi(A), P, \gamma(A)$	261.6**
$\phi, P(A), \gamma$	270.3	$\phi, P(A), \gamma(A)$	265.3
$\phi, P, \gamma(A)$	263.6	$\phi(A), P(A), \gamma(A)$	263.4*

# **Gray Catbird (*Dumetella carolinensis*)**

## **Vital Rates and Population Trends**

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	<b>Positive Strata</b>	<b>Negative Strata</b>	<b>Difference (pos – neg)</b>
<b>Productivity index</b>	<b>0.295</b>	<b>0.295</b>	<b>0.000</b>
<b>Adult survival rate estimate</b>	<b>0.555(0.033)</b>	<b>0.443(0.048)</b>	<b>0.112</b>
<b>Modeled population change</b>	<b>-0.271</b>	<b>-0.418</b>	<b>0.147</b>
<b>BBS population trend</b>	<b>0.102</b>	<b>-0.055</b>	<b>0.157</b>

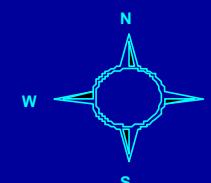
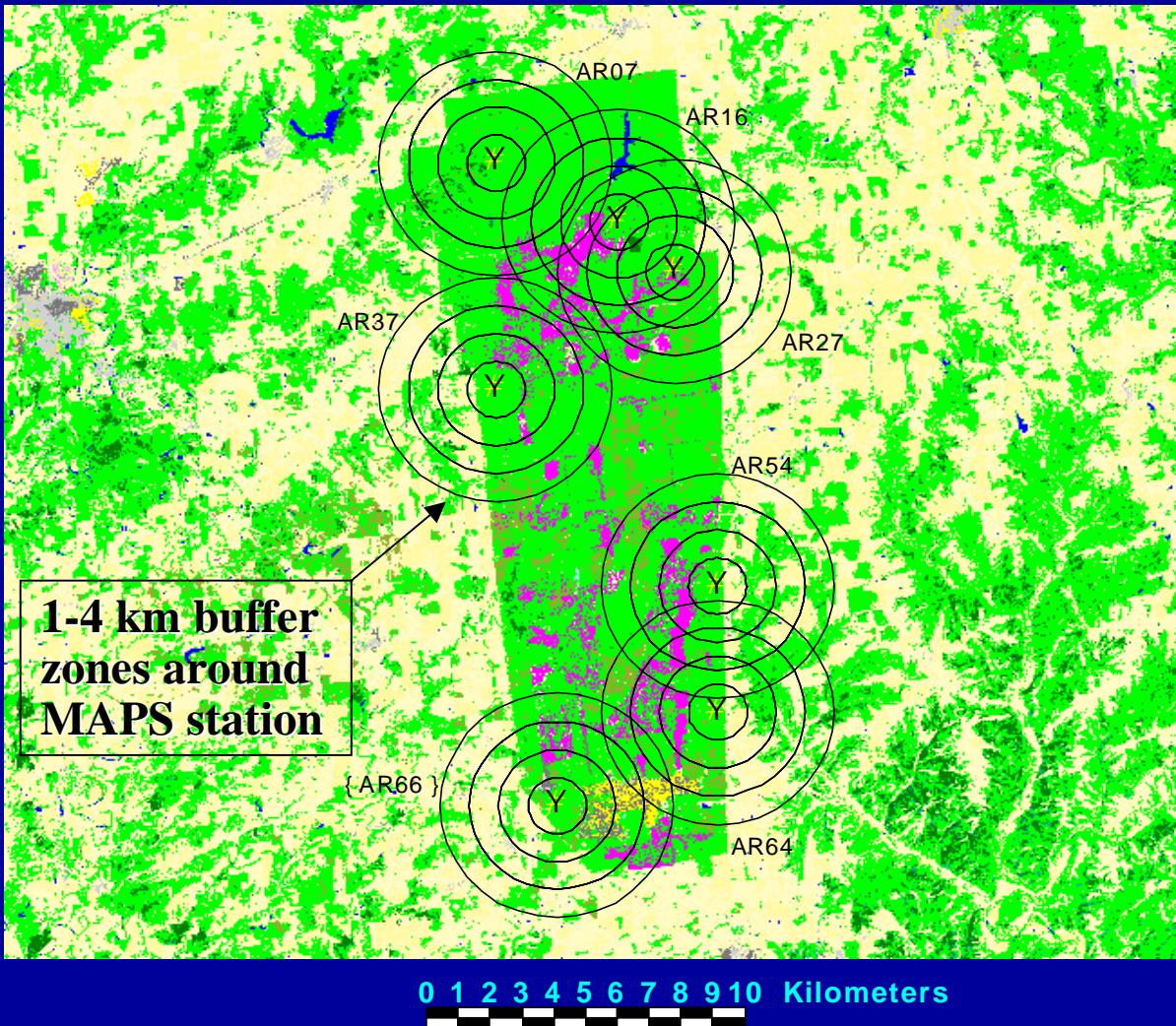
# **Formulating Landscape-Level Management Strategies for Reversing Productivity-Driven Declines in Landbirds**

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**For each of a suite of target species:**

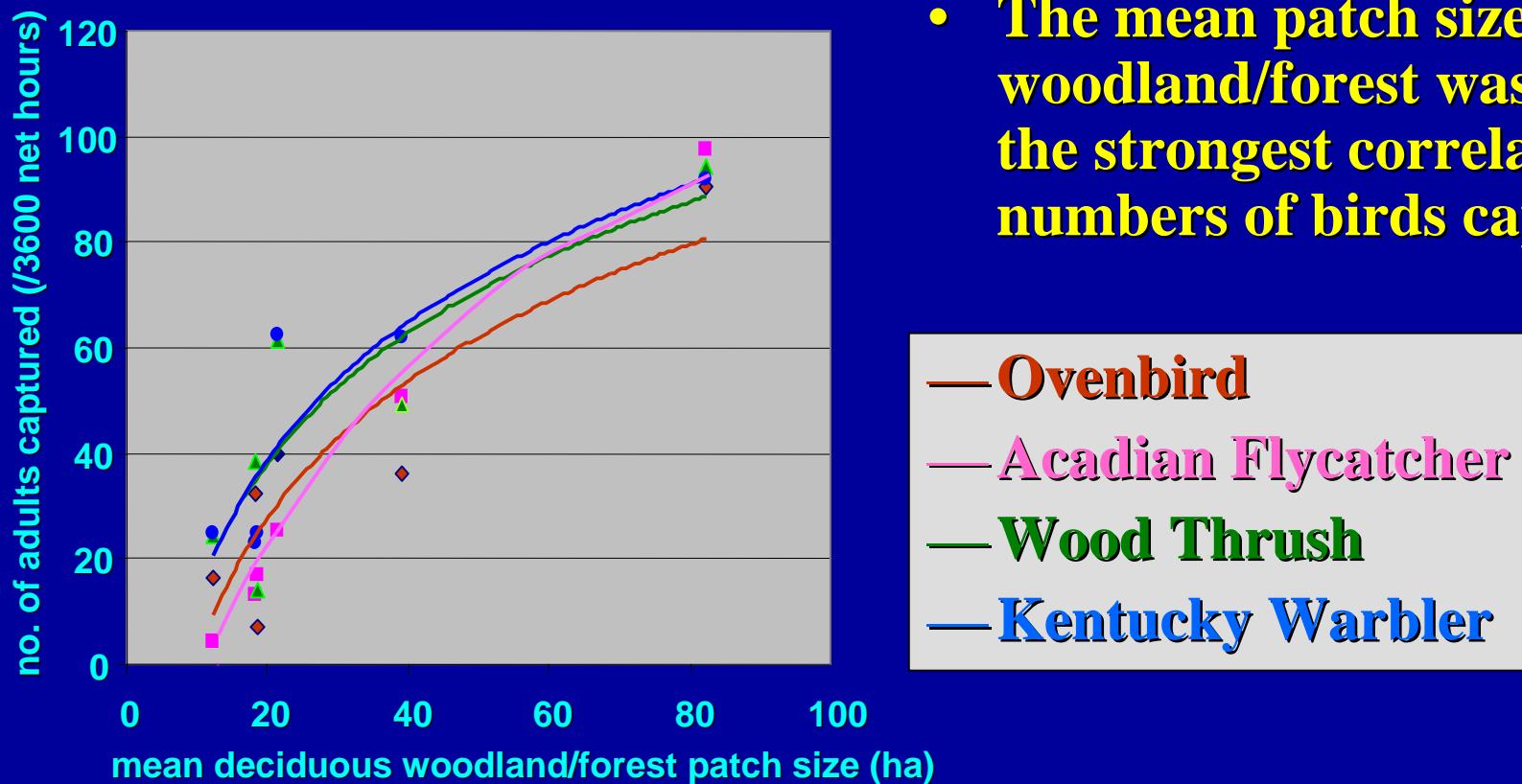
- Step I:** Identify geographic areas where low productivity is driving the population decline
- Step II:** Include appropriately scaled landscape-level habitat data in GIS-based models of productivity
- Step III:** Identify and describe relationships between landscape-level habitat characteristics and productivity
- Step IV:** Formulate management strategies to alter landscape-level habitat characteristics from those associated with low productivity to those associated with high productivity

# Jefferson Proving Ground MAPS stations located on Indiana MRLC coverage



# Establishing ecological relationships: I

Jefferson Proving Ground, Indiana:  
Landscape pattern and structure analysis



- Selected four most abundant forest interior species (1994-99)
- The mean patch size of deciduous woodland/forest was identified as the strongest correlate of the numbers of birds captured

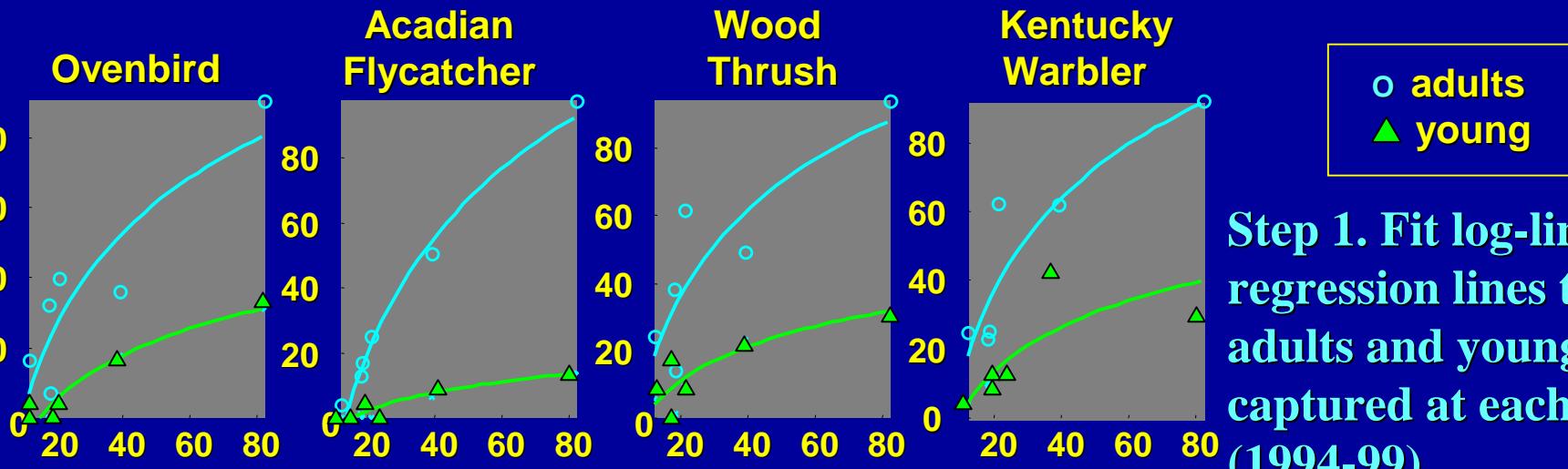
— **Ovenbird**  
— **Acadian Flycatcher**  
— **Wood Thrush**  
— **Kentucky Warbler**

\* All relationships are significantly positive (log-linear,  $p<0.05$ )

# Establishing ecological relationships: II

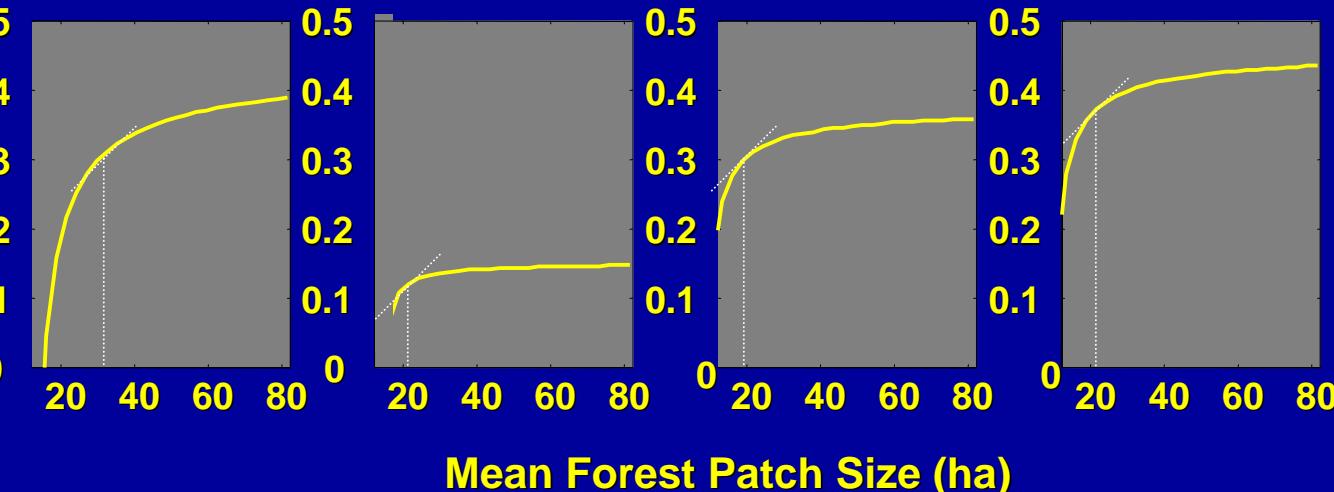
JPG MAPS data (1994-99): landscape determinants of productivity

No. of individuals



Step 1. Fit log-linear regression lines to adults and young captured at each station (1994-99)

Reproductive Index (Young/Adults)



Step 2. Derive relationship between reproductive indices and forest patch size from log-linear fits